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Cherish water & Clean nature

# KORVAN

GRP Sectional Panel Water Tank

Cherish water & Clean nature

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Korvan Company Limited

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Revision 4

WRAS APPROVED PRODUCT PSB TEST

KQA Q.Assurance

**KORVAN**  
Korvan Company Limited

*Cherish water and Clean nature* **KORVAN**

### ● CEO Message

We are pleased to introduce ourselves as a dedicated manufacturer of GRP products in Korea. We are a front-runner in the creation of a better living environment using high technology, the newest facilities and high-quality manufacturing capabilities. Based on unsaturated polyester, we manufacture GRP sectional panel for water tank and artificial stone such as Sink top, Sink bowl, Bath tube, Ceiling panel by huge hydraulic press

Since the establishment in 1996, we have worked to develop improved living environments through continuous research and investment.

Now we expand business stage to the whole Asia, the Middle East, Africa and Oceania in order to afford a high qualified products to global customers. And we will keep working to become an enterprise that creates the worldwide value of the living environment, sharing most useful products with global customers.

Always we think over our customers as we do our own family, working hard to cultivate the health and living environment-oriented business. We will grow up as a world-renowned superior enterprise, realizing the best in customer satisfaction by providing excellent products and services for the living environment, and by establishing corporate and organizational cultures suitable for the global environment.

Thank you.

Sincerely yours

Yong-Ki Lee  
CEO




Headquarter



Export-Award Tower  
(A hundred million dollars)

### ● Company history

- |                 |   |
|-----------------|---|
| <b>1996 Apr</b> | ▪ Established Korvan Ind. Co., Ltd<br>Commenced the production of Ferrovanadium                           |
| <b>1998 Dec</b> | ▪ Achieved annual sales 10 billion KRW and passed 1 million US dollars exports mark                       |
| <b>2001 Apr</b> | ▪ Established 2nd factory for Press Molding Plant   |
| <b>2002 Jan</b> | ▪ Started the production of artificial stone for Sink-top, Sink-bowl, Table top, Bath tube, Ceiling panel |
| <b>2003 May</b> | ▪ Researched and developed GRP sectional panel and accessory  |
| <b>2004 Mar</b> | ▪ Started to manufacture GRP sectional water tank   |
| <b>2007 Jan</b> | ▪ Acquired ISO9001  |
| <b>2007 Feb</b> | ▪ Selected as an INNO-BIZ corporation   |
| <b>2008 Feb</b> | ▪ Contracted distributorship with Thermoset Technologies LLC for UAE market                               |
| <b>2008 Apr</b> | ▪ Established the Industry Material R&D center  |
| <b>2008 Dec</b> | ▪ Awarded 100 million dollars export-tower by Prime Minister  |
| <b>2010 Mar</b> | ▪ Acquired WRAS(Water Regulation Advisory Scheme) certification   |
| <b>2010 Nov</b> | ▪ Acquired PSB Singapore certification  |



Main Factory



## KORVAN Industry Material R&D Center

is doing its best to maximize the customer's profits through hygienic and safe product development and exhaustive quality control measures under the objective of creating living environments which global customers can enjoy together.

### Approved by world best quality certification

Certificate of WRAS (Water Regulations Advisory Scheme – United Kingdom)  
NO 0907543 ( Sections 5120 )

Korvan GRP Sectional Water Tank meet the requirements of WRAS Test of effects on Water Quality/BS6920 : 2000/ Odour and Flavour of water test : and is suitable for use with Hot and Cold water



Certificate of PSB(Productivity and Standards Board – Singapore)  
Test specification SS245 as the safety for 6 times water pressure

Approved by PSB(Singapore Productivity & Standards Board) Test specification SS245 as the safety for 6 times water pressure and sanitation for potable water



Analysis for raw material

Test for Panel Transformation

Test for Hydraulic Pressure



PSB test for 1m x 1m x 4mH

### Certifications



WRAS

PSB

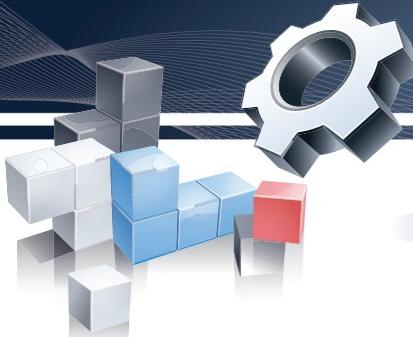
ISO9001

KTR TEST REPORT

### Physical property

Korvan panel and reinforced parts confirmed by a strict quality standard

ITEM	VALUE
Tensile strength	99.5MPa
Flexural Strength	165MPa
Flexural Modulus of Elasticity	13800MPa
Barcol Hardness	70
Absorption Rate	0.01%
Glass Fiber Content	32.1%
Odor & Taste	No Defects
Turbidity	Below 0.5 degree
Color	Below 1 degree
Light Transmission	Nil
Heavy Metals	Not Detected
Consumption of KMnO4	0.3mg/L
pH(20°C)	6.9
Phenol	Not Detected



## Process of erection Korvan GRP sectional water tank



Cutting and measure SMC sheets



Molded by hot hydraulic press



Inspect GRP panel



Drill on the GRP panel



Concrete foundation for the erection of water tank



Assemble bottom panel



Erect wall and partition panel



Assemble roof panel and manhole



**Delivered high quality products to global customers**

It is the time for you enjoy Korvan water tank with best Quality and leading Technology.



Resort club / Korea / Size 16 x 17 x 4m/h : 1088 Ton



Labour City / UAE / Size 12 x 12.5 x 2m/h : 300 Ton



Dubai / UAE / Size 7 x 9 x 2m/h : 126 Ton



Sudan / Size 7 x 8 x 3m/h : 168Ton



Dubai / Size 7 x (5+5) x 2m/h : 140 Ton (78 Set)



Sudan / Size 9 x 25 x 4m/h : 900 Ton



## What is GRP Water Tank?

GRP Sectional Panel Tanks are constructed of panels made from SMC(Sheet Molding Compound) by hydraulic hot press under high temperature (150°C) and pressure conditions to maintain the best endurance.

Using stainless steel for the interior structure and plated steel for the exterior, the panel exhibits excellent resistance to erosion.

Easy installation with on-site bolt assembly and Tank shape and volume can be freely designed with no restrictions based on site location, weather or climate.



### COMPARISON : Korvan GRP panel type vs Other types

	Water quality	Water tightness	Durability	Transportation	Maintenance	Anti-corrosion	Installation
Korvan GRP Panel tank	◎	◎	○	◎	◎	◎	◎
Concrete Tank	X	△	△	X	X	◎	△
Steel Tank	△	◎	○	△	X	X	X
Stainless Steel Tank	◎	◎	○	△	△	△	X
GRP Hand Lay-up tank	△	◎	○	X	△	◎	○

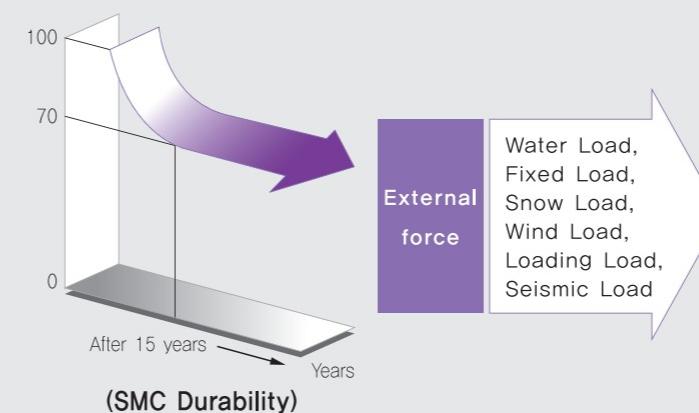
◎ : Very good    ○ : Good    △ : Normal    X : Poor

\* It is possible that the roof panel of stainless steel tank get rust by high concentration of chlorine contents

## Structural Analysis of Korvan GRP Panel

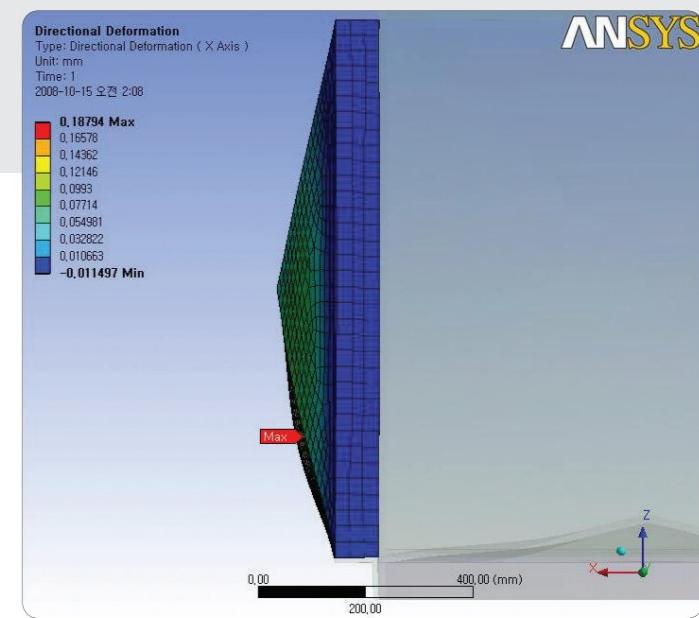
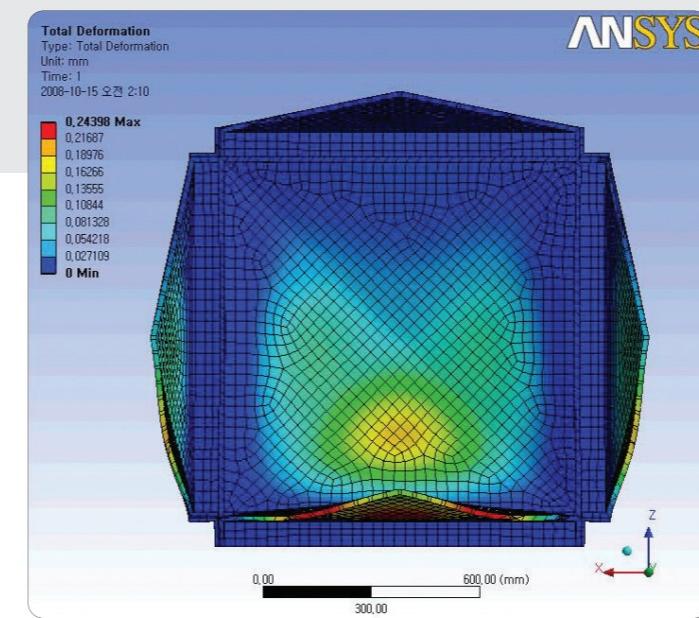
Korvan GRP water tanks are designed to be the safest panels through optimized design.

If the panels are reliable, the cost of reinforcement can be reduced and the best water tanks can be made at the most economic cost.



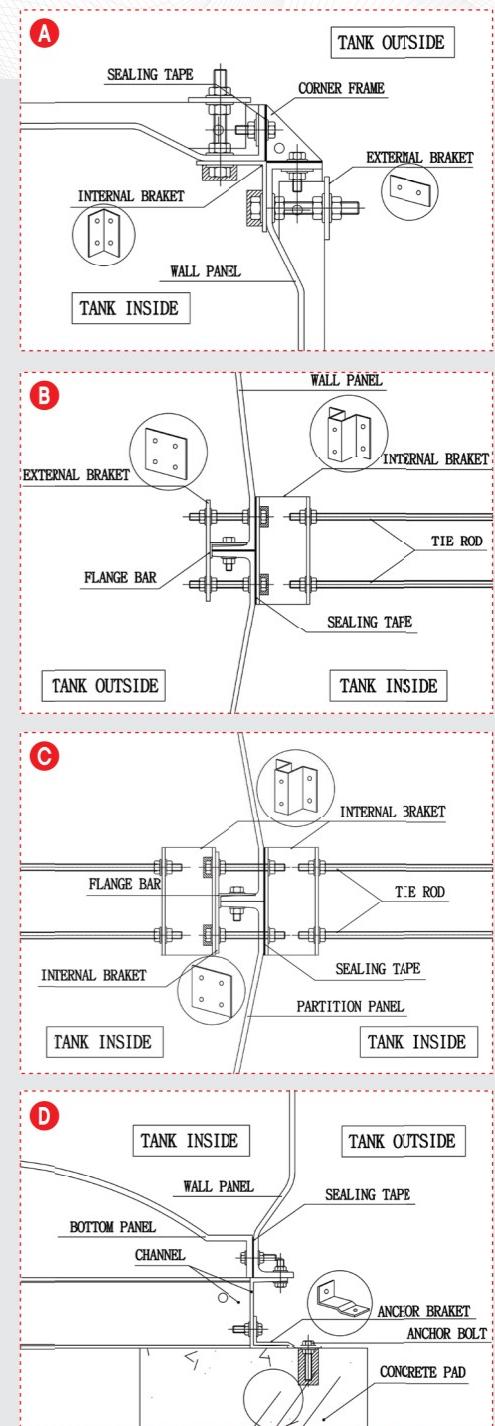
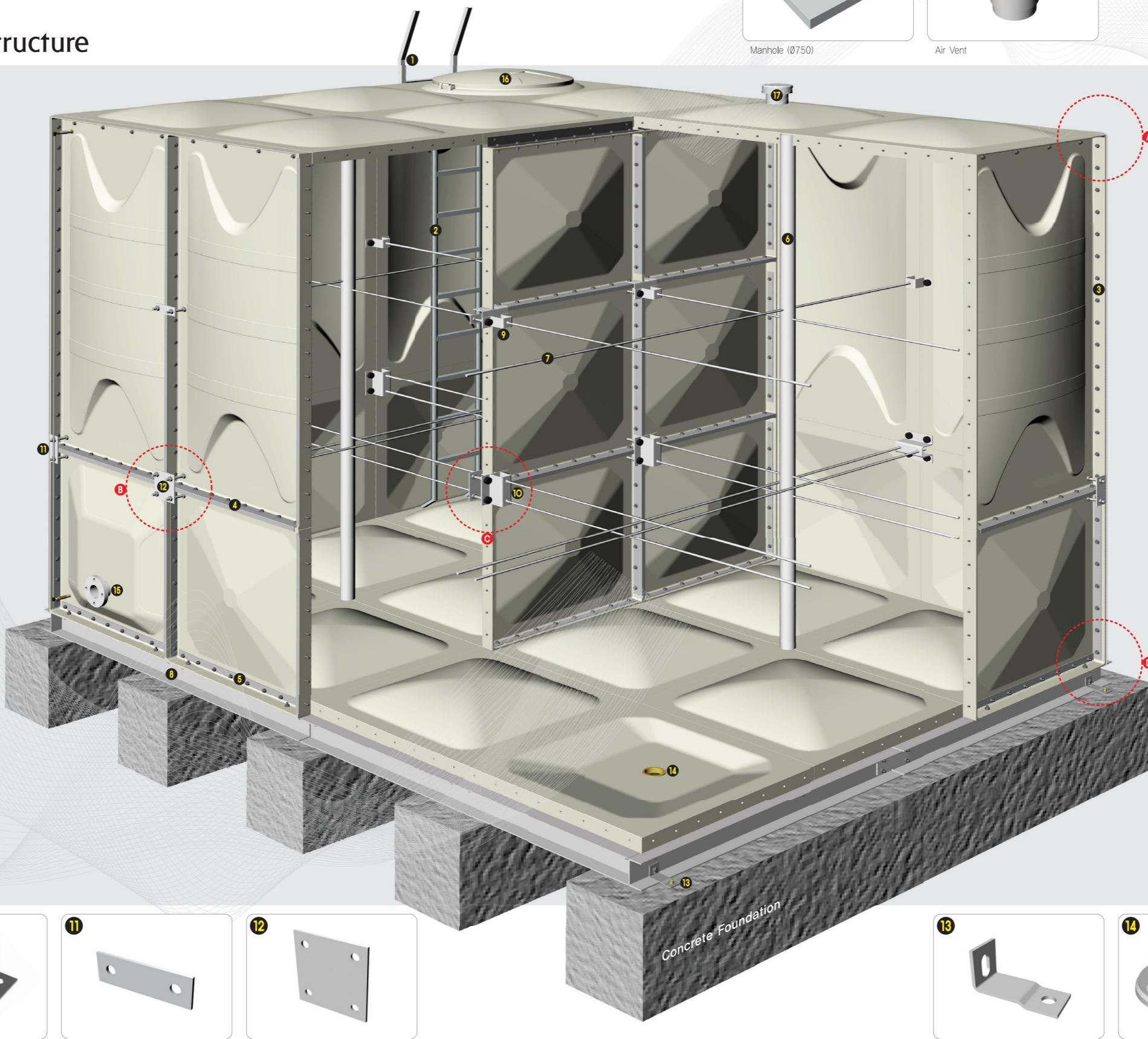
Design Basis : External force < Maximum feature / Safety Factor	
Item	Design Condition
Seismic load	horizontal Seismic Kh = 2/3   Vertical Kv = 1/3 Designed bases on Kh = 1/3G, horizontal seismic load. Water Level [Height in Meters] x 0.1KGF/cm² [0.01MPa]
Hydrostatic Pressure	Designed to stand against hydrostatic pressure enough The max. change of side wall is less than 1.0% of total height left in Water for 48 hours.
Snow Load	60 kgf/m² [at the base of 30cm of snow depth] Designed to stand under 200kg/m² enough
Wind Load	Wind Load – 255 kgf/m² [2,55 x 10⁻³ Mpa] Designed to stand under max, 60m/sec even in case tank dose not include water,
Illumination	Illumination – Under 0.1%
Water Temperature	Under 30°C (normal) / Under 50°C (maximum) (Special making in case of thermal spring)

### Structural Design of wall panel (1m X1m)

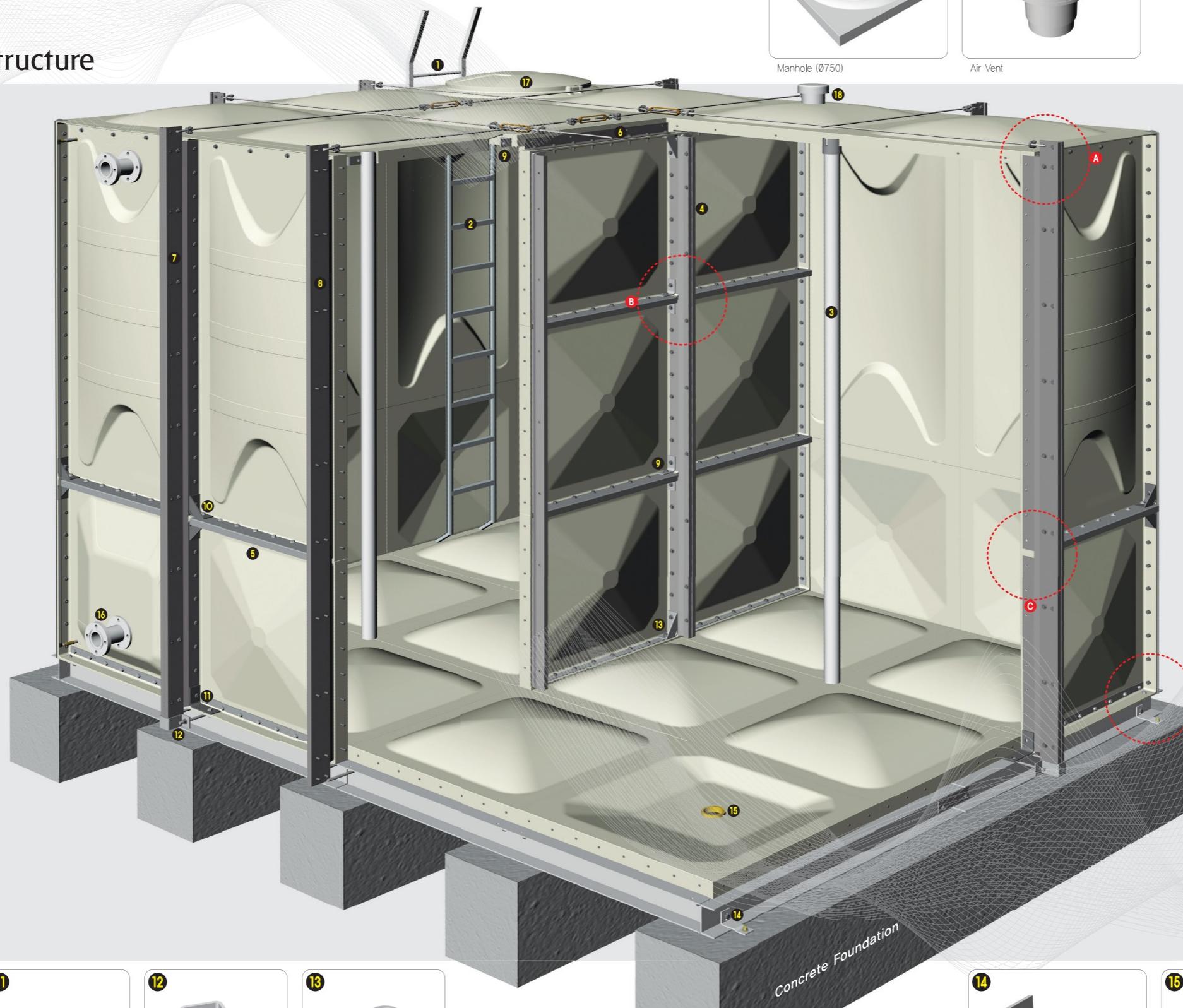
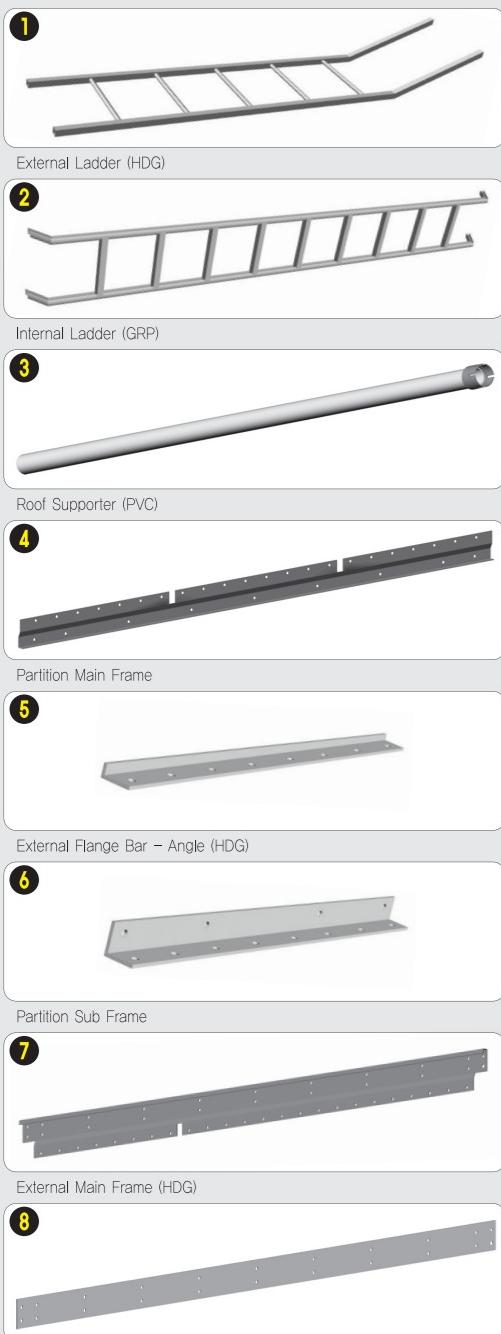




## GRP water tank Internal reinforcement structure



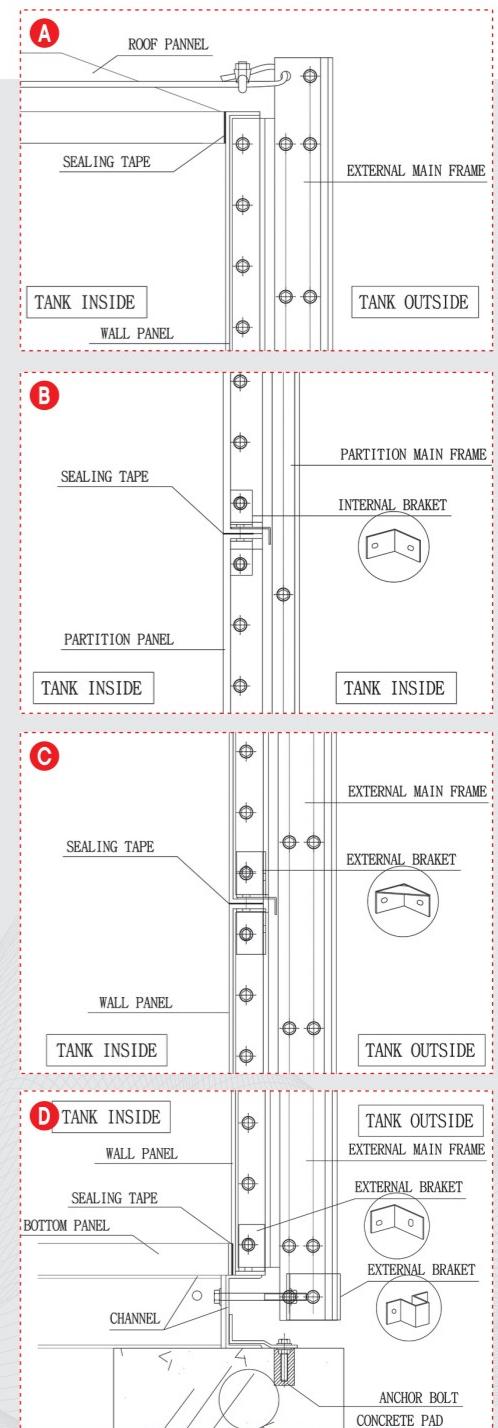
# GRP water tank External reinforcement structure



Manhole (Ø750)

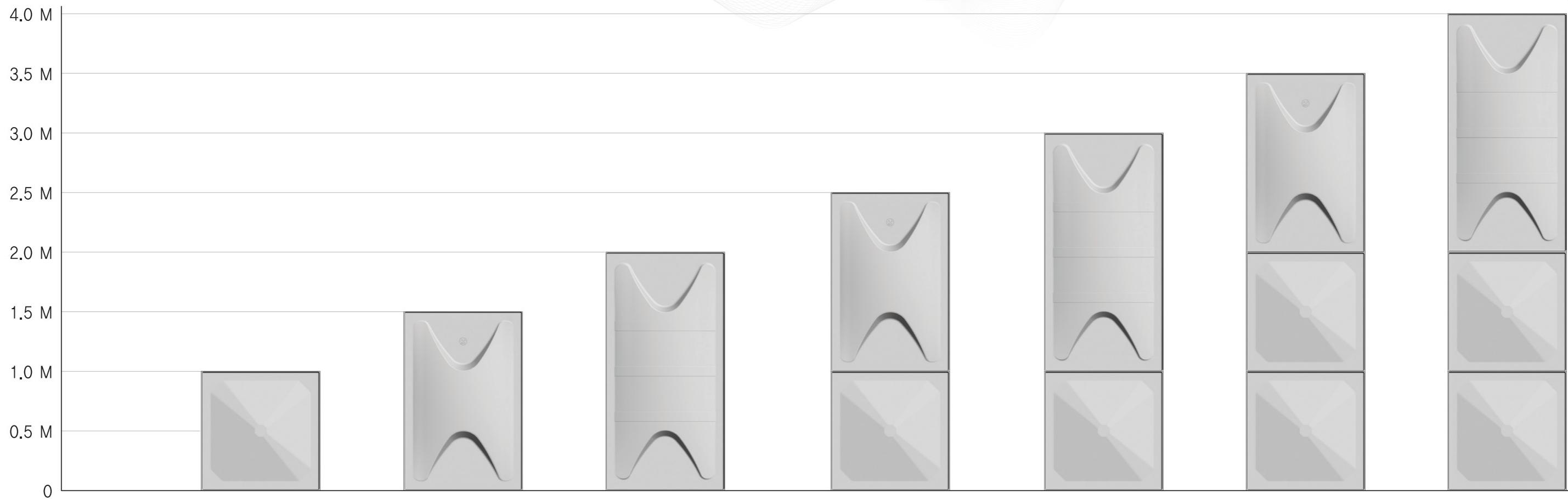


Air Vent





## Various Shape and Size of Korvan GRP Panel

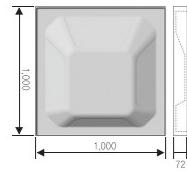


### ● Own designed panel

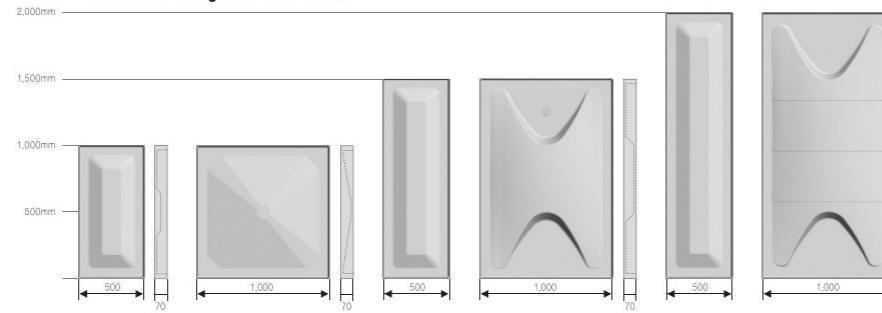
Korvan produces exclusive panels and providing such as partition, manhole, flange and drain by the purpose.

### ● Exclusive Panel for connecting Flange

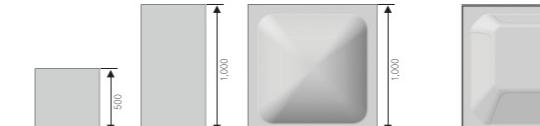
Development of Exclusive Panel for Flange in Korea.



### ● Various design for wall Panel



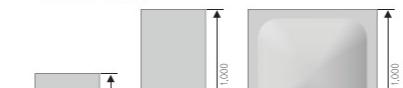
### ● Bottom Panel



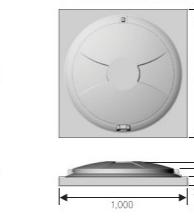
### ● Drain Panel



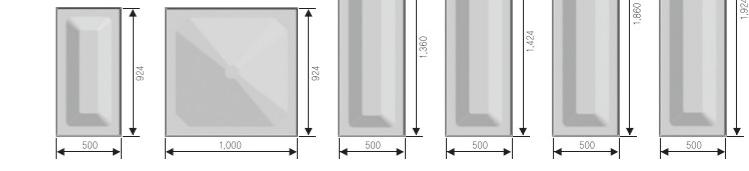
### ● Roof Panel



### ● Manhole Panel



### ● Partition Panel





## Features of Korvan GRP sectional water tank

### Super Hygienic

Korvan panel which is certified WRAS is possible to make the GRP panels in a variety of colours.

In most cases, however, this type of tank is installed in the open, exposed to direct sunlight. If the GRP panels are translucent, the growth of algae and other micro-organisms would be accelerated.

After extensive testing and research, Korvan has adopted panel to minimize this problem, completely opaque and does not permit the passage of any light through it.

A typical problem with steel tanks has always been the high thermal conductivity and expansion of coefficient of steel. These characteristics can cause loosening of the panel connecting bolts in areas of wide temperature change



Cracked surface for Concrete water tank after 3 years installation

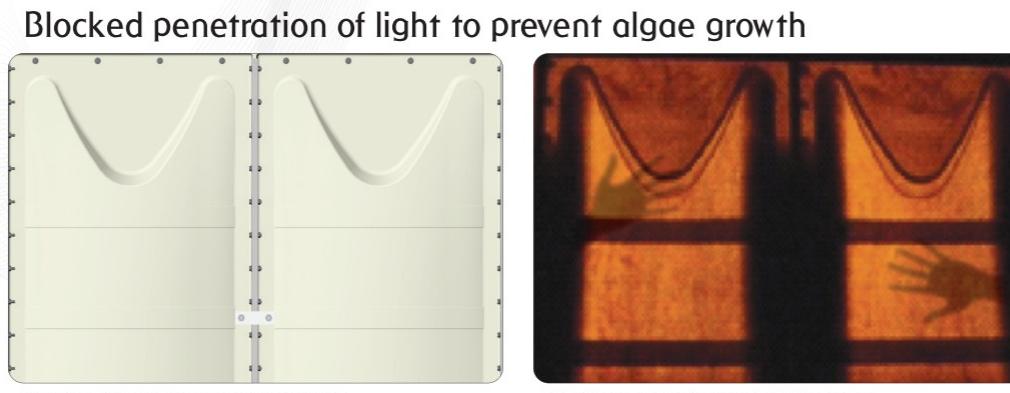


Rusted steel for STS Water tank after 3 years installation



Inside state of Korvan GRP Water tank after 3 years installation

**WRAS**  
APPROVED  
PRODUCT



KORVAN panel : Prevent light penetration

Other tank : High light transmissible panel

### Various design by water tank capacity

Various sized panels can make the below tanks that utilize the most horizontal & perpendicular space and also can be erected from small capacity tank to huge tank.



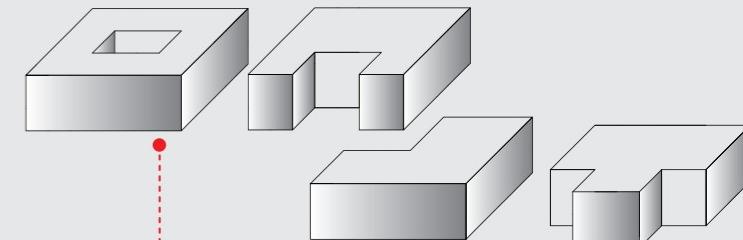
1,000 Liter for home



90,000 Liter for industry



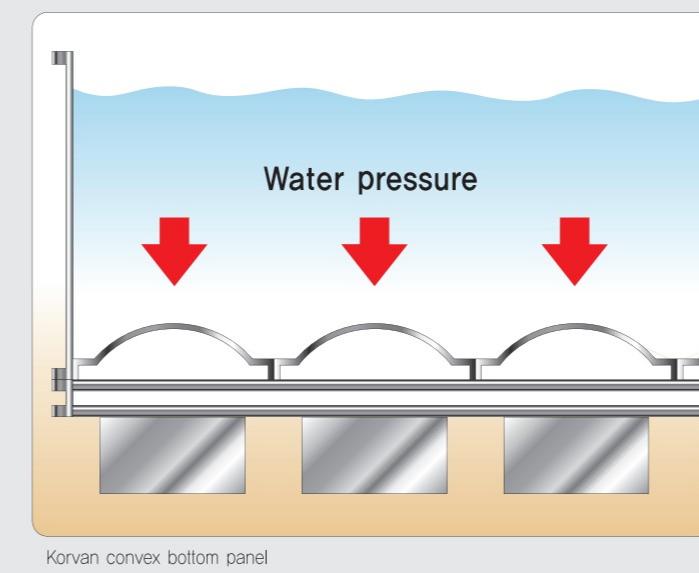
1,080,000 Liter big project



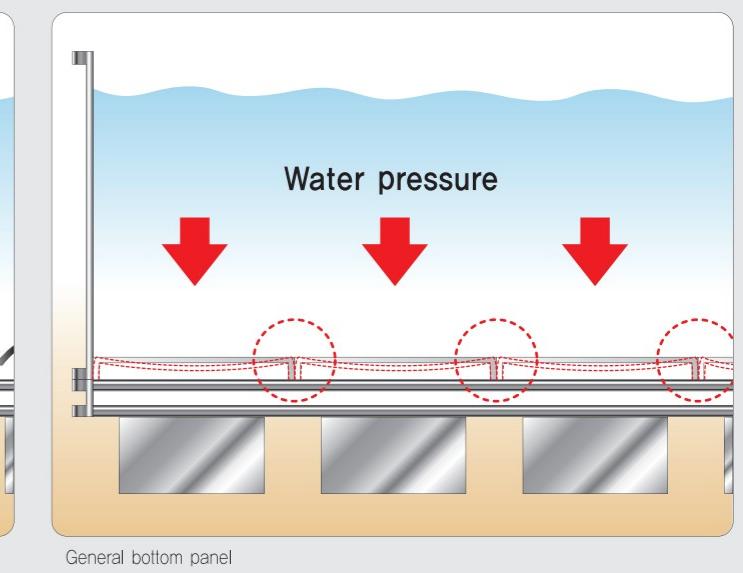
Pillar : construction of □ Type

### Safety of water pressure

The convex bottom panel can be the water pressure created by filling the tank seals the joints preventing leakage. In other type tanks, water pressure can loosen the joints breaking the seal, and allowing the stored water to leak out.



Korvan convex bottom panel

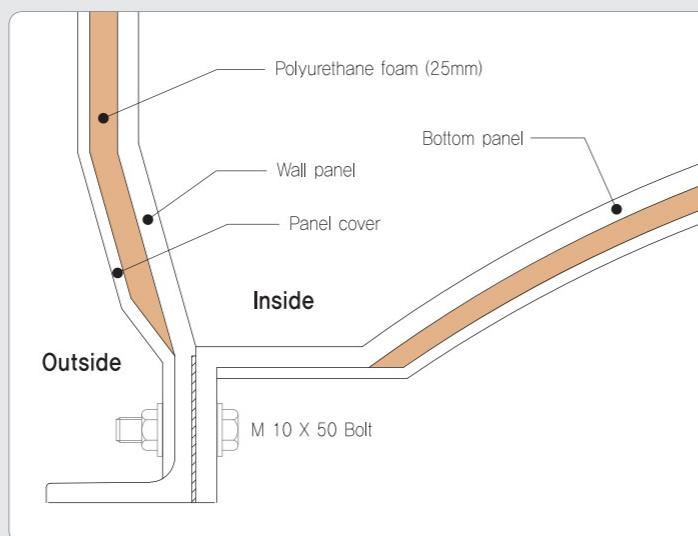
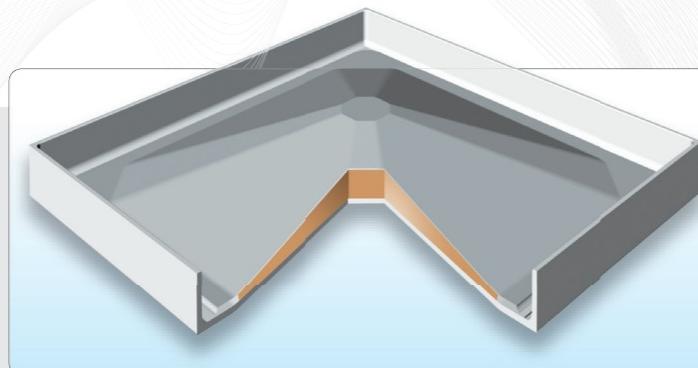


General bottom panel



## Excellent Insulation

The heat insulation panel with 3 layers structure improves heat insulation effect, protects water condensation on the outside of the tank and minimizes temperature variation of the stored water.

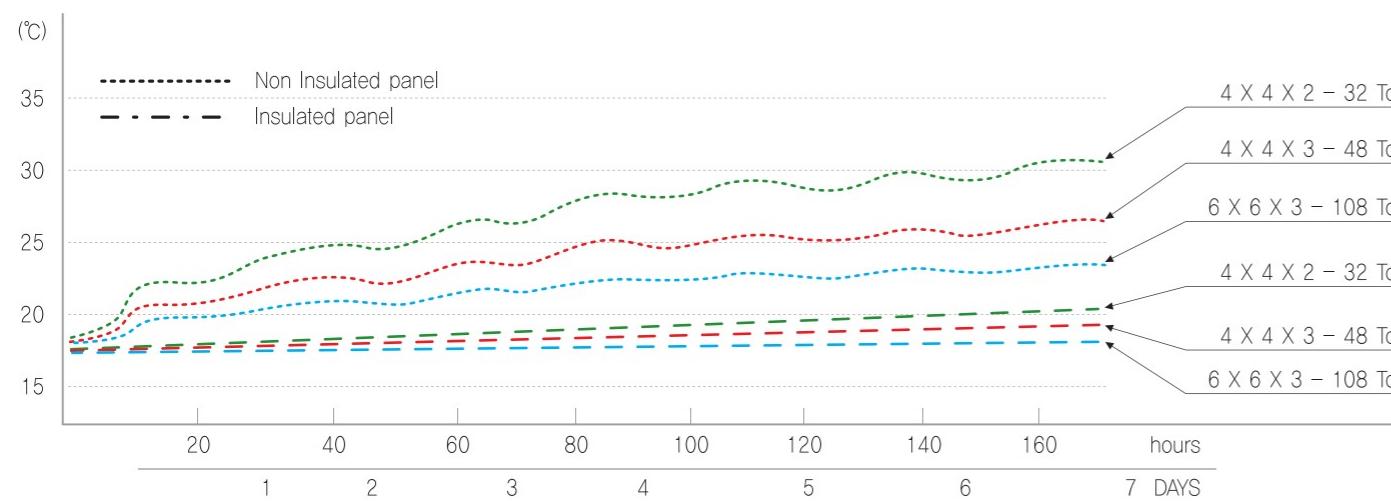


### Comparison of Thermal Conductivity

Tank type	Thermal Conductivity Kcal / m² hr°C (j / m² hr°C)	
STEEL	37.0	(1.55 X 100,000)
GRP (Non-insulated)	0.15	(630)
GRP (Insulated)	0.02	(84)

Tank type	Coefficient of Overall Thermal Transmission Kcal / m² hr°C (j / m² hr°C)	
	Air – Panel – Air	Water – Panel – Air
STEEL	14.3 (59.9)	24 (100)
GRP (Non-insulated)	3.0 (13)	5 (21)
GRP (Insulated)	0.9 (3.8)	1 (4)

### Temperature curve for inside water tank



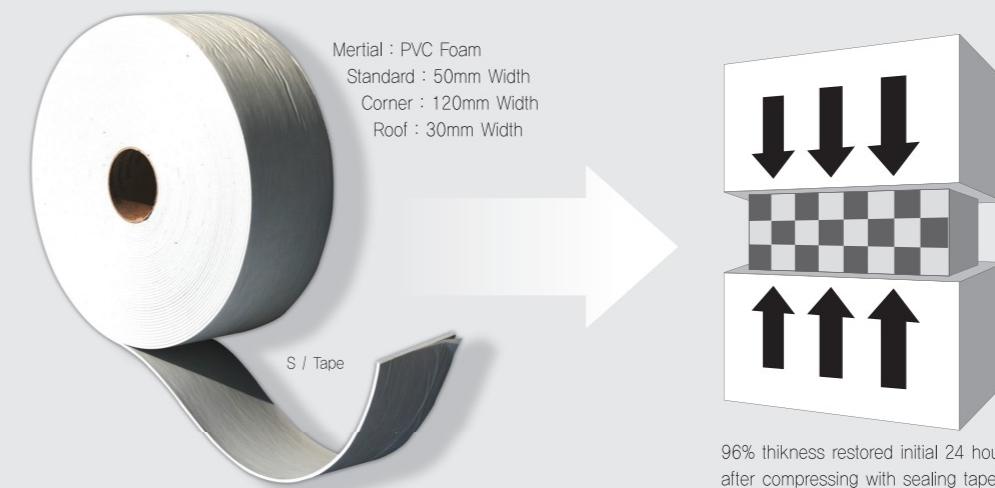
## Water Tightness

The joints are sealed with a special sealing tape for GRP sectional panel water tank with long experience and technology.

It maintains soft itself and adhesives even at low temperature.

The combined flange thickness at the panel joints is sufficient to meet any stress imposed.

This self-sealing feature eliminates the possibility of separation and hence prevents water leakage of the tank.

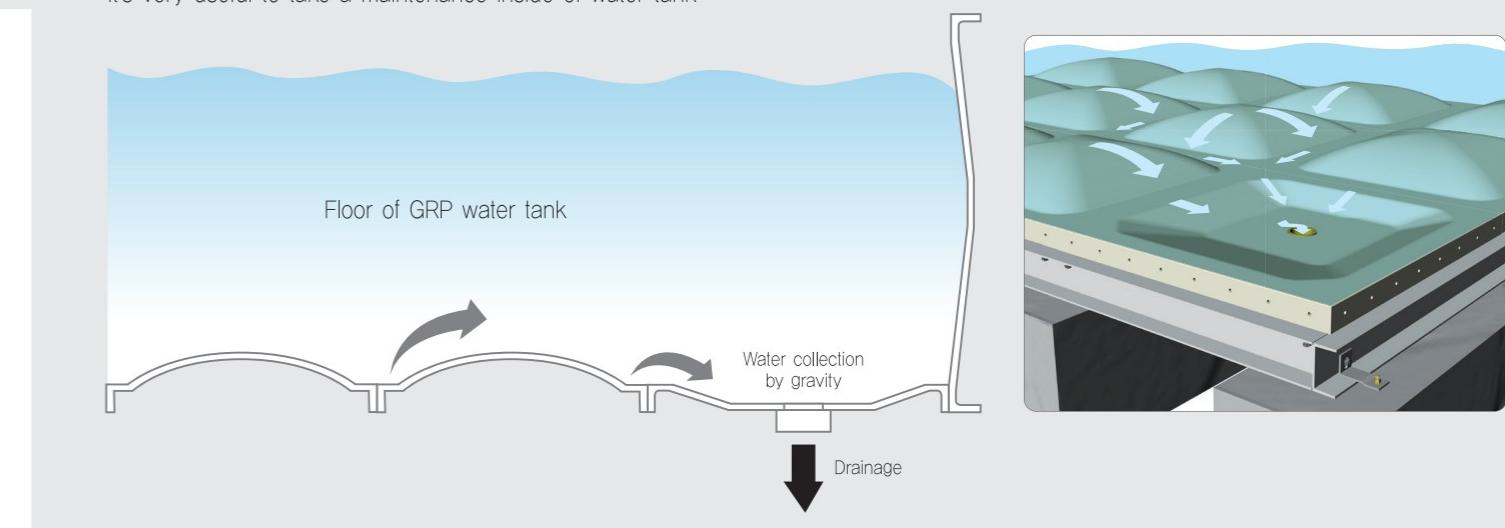


PSB test report for sealing tape

## Complete Drainage

The convex bottom panels with a concave drain panel system make sure complete and fast drainage.

It's very useful to take a maintenance inside of water tank



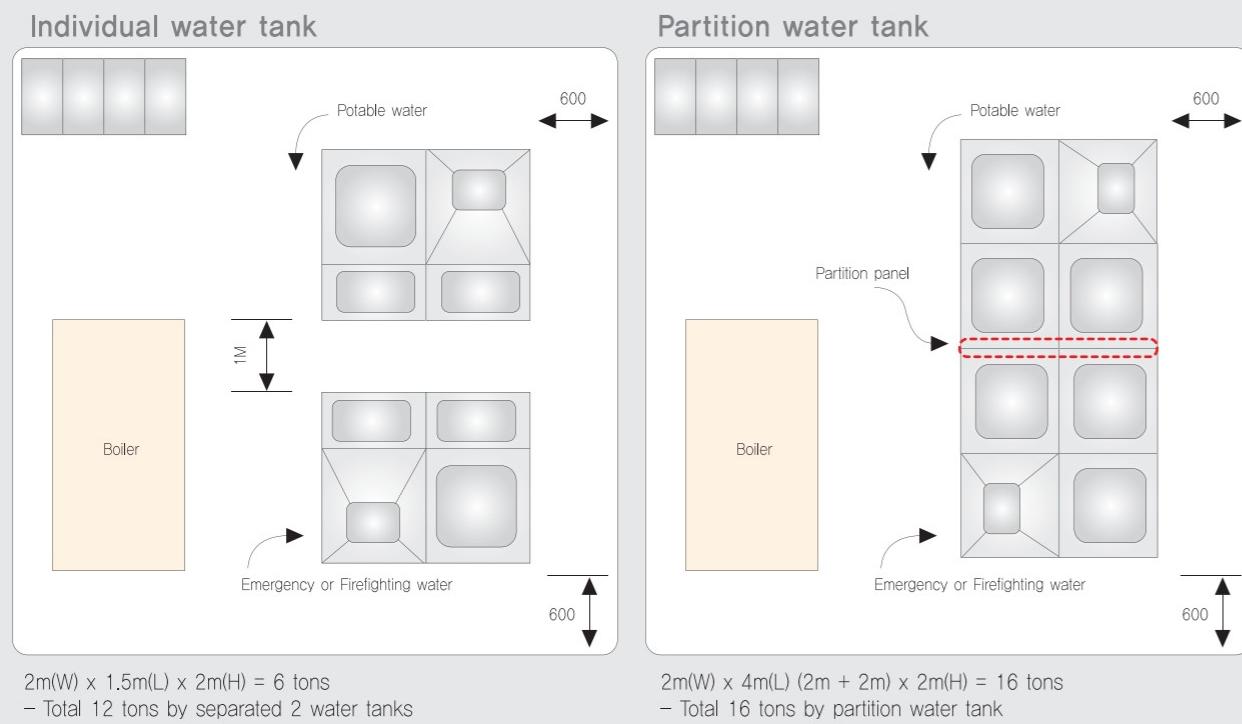


World Best Quality & Technology

## Partition Water tank

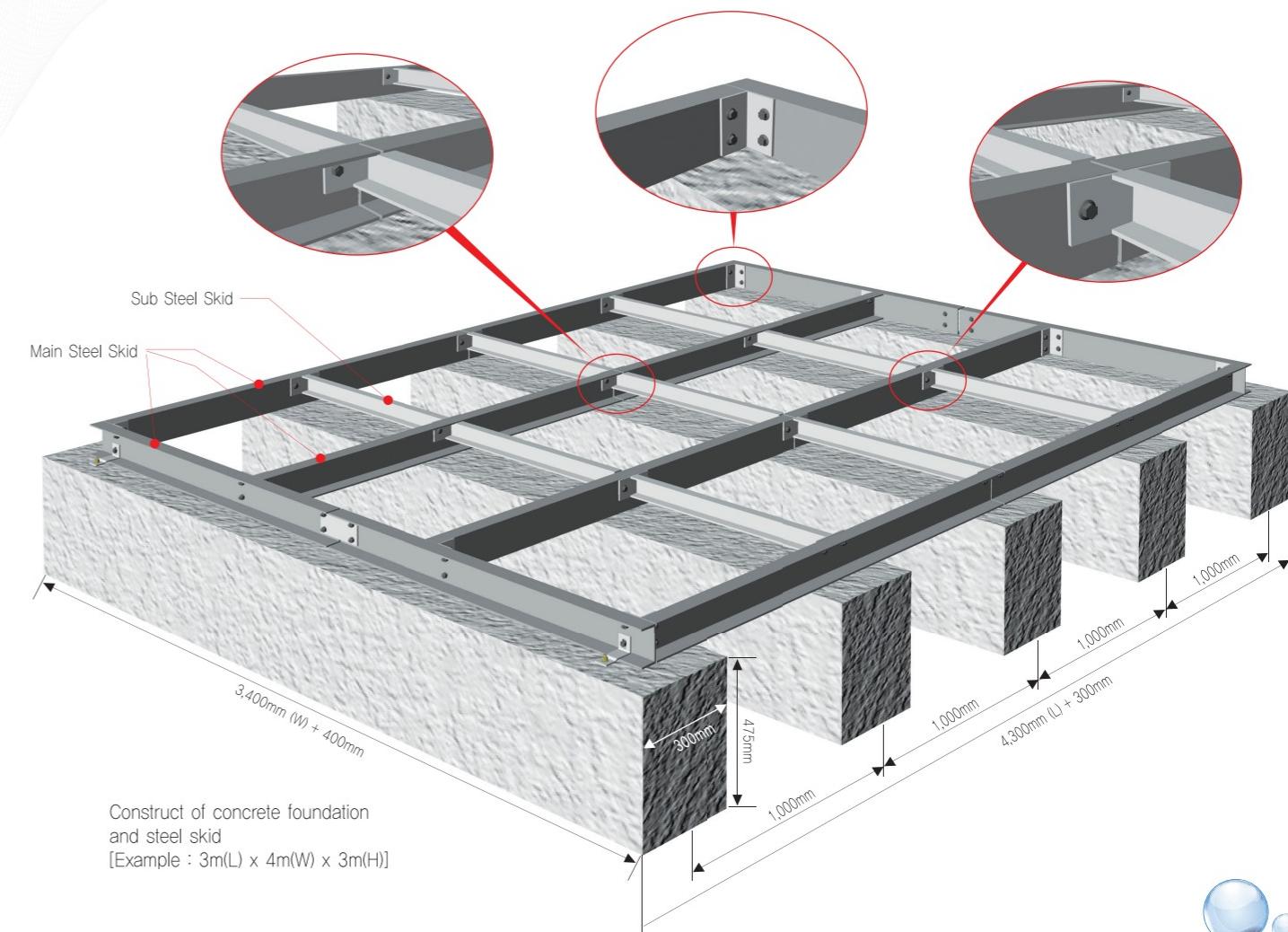
### Suitable for the confined area

The water tank for two different purposes are needed in a confined area or boiler facility. As an example 16 tons water tank, the partition type can be divided by two tanks in one as using half(8 tons) for drinking water and another half(8 tons) for service water. If the separated water tank installed as shown on the below picture, you have to install two different tanks with a maximum each 6 tons, because you need to keep 1 meter distance between each separated tanks for maintenance and operating space.



## Base Concrete

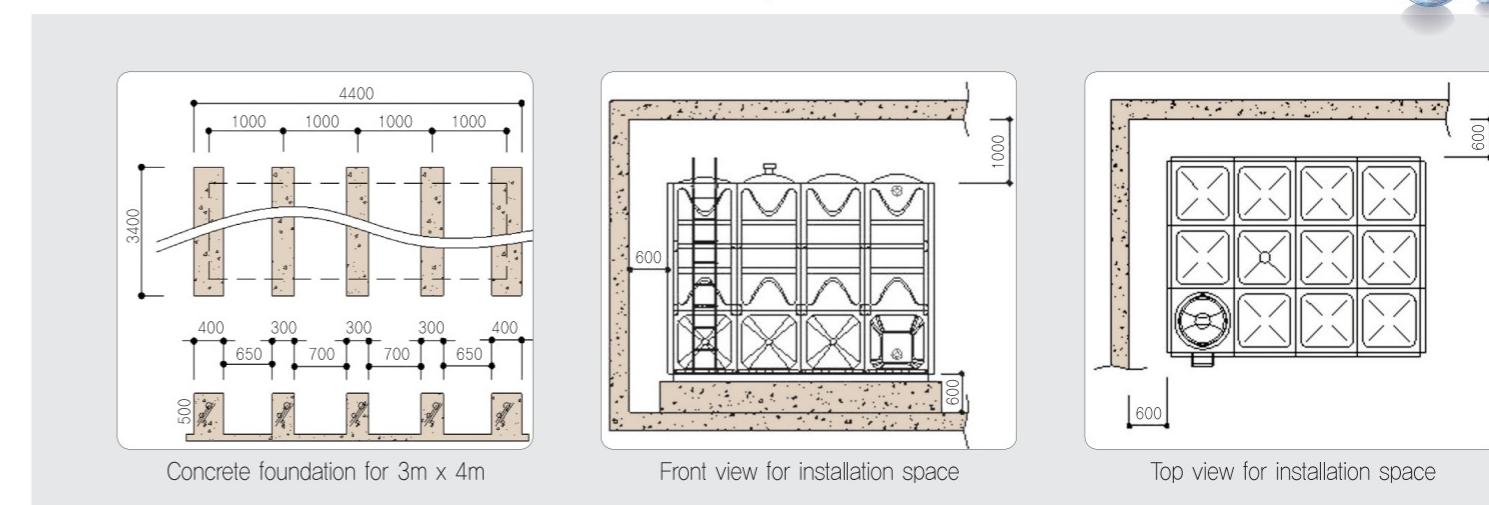
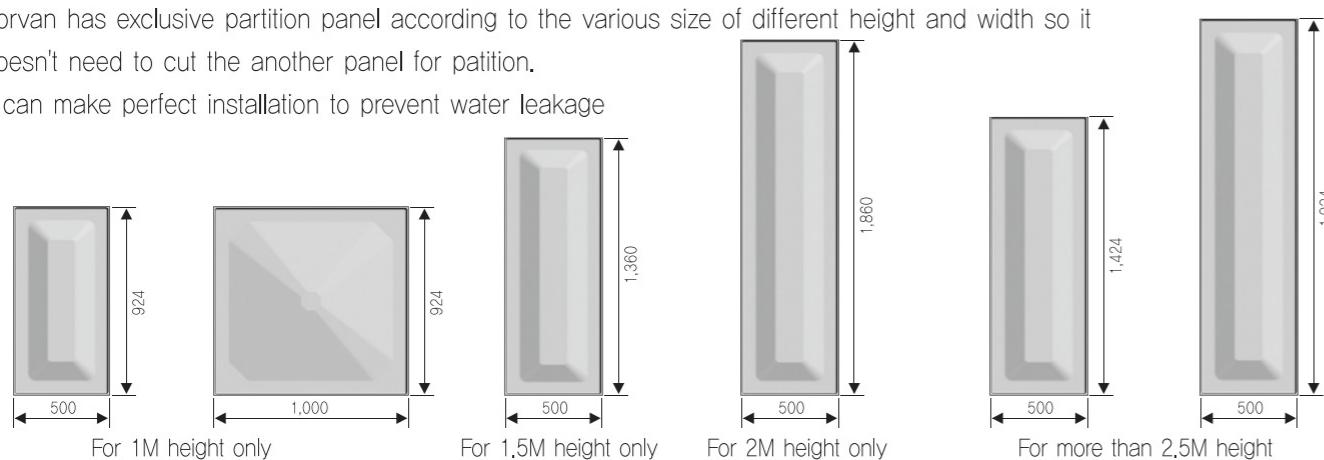
- Customers should construct a concrete foundation according to the designated water tank specification and the firmness of the site.
- The strength of the base concrete should be at least 180kg/cm<sup>2</sup>
- The thickness of mortar on the base concrete should be less than 20mm



### ● Various panel size for partition type water tank

Korvan has exclusive partition panel according to the various size of different height and width so it doesn't need to cut the another panel for partition.

It can make perfect installation to prevent water leakage





## Specification of steel skid

1. Durability reinforcement parts by optimized structural designed
2. Providing all accessories to able erect water tank at construction site
3. Safety construct by bolt assembly without welding and make a short construction period and reduce the cost

Tank Height	Steel skid A (Main)		Steel skid B (Sub)	
Height 1m ~ 2m	angle 75 X 75 X 6mm		channel 75 X 40 X 3mm	
Height 2.5m ~ 4m	channel 125 X 65 X 6.5 X 8mm		channel 75 X 40 X 6mm	
Height 4.5m ~ 5m	channel 150 X 75 X 8 X 10mm		channel 100 X 50 X 6mm	

\* The above list is recommendable standard. It can be redesigned by customer's requirement and condition of construction site.

### ◆ Steel skid assembly by Angle type

	Steel skid A	Steel skid B
1M	1140L	990L
1.5M	1640L	957L / 527L
2M	2140L	957L / 1206L
2.5M	1575L / 1070R	957L / 563L / 957L
3M	1570L / 1570R	957L / 1063L / 957L
3.5M	1570L / 2070R	957L / 994L / 563L / 957L
4M	2070L / 2070R	957L / 994L / 1063L / 957L
5M	2070L / 1000L / 2070L	957L / 994L / 1063L / 994L / 957L

### ◆ Steel skid assembly by Channel type

	Steel skid A	Steel skid B
1M	1120L	990L
1.5M	1620L	962L / 527L
2M	2120L	962L / 1021L
2.5M	1560L / 1060R	962L / 553L / 962L
3M	1560L / 1560R	962L / 1053L / 962L
3.5M	1560L / 2060R	962L / 994L / 553L / 962L
4M	2060L / 2060R	962L / 994L / 1053L / 962L
5M	2060L / 1000L / 2060L	962L / 994L / 1053L / 994L / 962L

## Specification of connection

### 1. Specification of connection

- Able to supply all installation accessories including connection by customer's requirement
- Customer should inform the specification of inlet, outlet, drain and overflow size.
- The below list is for Korvan standard connection for customer's reference

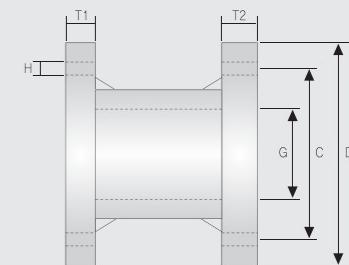
### Standard Connection Size

Water tank capacity(m³)	Inlet	Outlet	Overflow	Drain
1m³ ~ 10m³	25A	50A	50A	25A
11m³ ~ 20m³	40A	50A	50A	40A
21m³ ~ 50m³	50A	65A	65A	40A
51m³ ~ 100m³	65A	80A	80A	50A
101m³ ~ 200m³	80A	100A	100A	50A
201m³ ~ 500m³	100A	125A	125A	80A
501m³ ~	125A	150A	150A	80A

### 2. Connection line-up

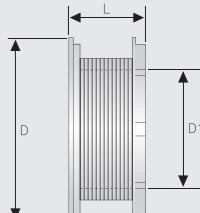
#### ◆ Flange Type (PVC)

mm / inch	D	T1	T2	G	L	C	Hole
65A (2 1/2)	175	20	25	77	140	140	4
80A (3)	185	20	25	90	140	150	8
100A (4)	210	20	25	115	140	175	8
125A (5)	250	20	25	140	140	210	8
150A (6)	280	20	25	170	140	240	8
200A (8)	330	22	25	220	150	290	12
250A (10)	400	24	25	270	170	355	12
300A (12)	445	24	25	320	170	400	16



#### ◆ Socket Type (Brass)

mm / inch	D	D1	L	T
15A	43	19	26	1.5
20A	46	25	30	1.5
25A (1)	53	31	32	1.5
32A (1 1/4)	66	39	35	1.5
40A (1 1/2)	73	45	36	1.5
50A (2)	85	57	40	1.5
65A (2 1/2)	111	72	46	2



### Caution for the connection

- Install a prop while installing piping and take care not to put an excessive load
- Install pipes on the site where the tank is located and take care not to put on the biased load